BY ORDER OF THE COMMANDER
HEADQUARTERS AIR FORCE FLIGHT TEST CENTER (AFMC) EDWARDS AIR FORCE BASE, CA 93524-1000

AFFTC INSTRUCTION 99-5

10 May 2002

Test and Evaluation

TEST CONTROL AND CONDUCT

COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

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This instruction specifies the responsibilities of key personnel and procedures for the control and conduct of flight and ground testing for which the Air Force Flight Test Center (AFFTC) is responsible. It presents guidelines on the preparation of test procedures and test cards, test team member qualifications and training, and control room procedures for test missions that require some form of real-time data monitoring and control. It applies to all AFFTC units and detachments regardless of their operating location.

Summary of Revisions

A new section has been added to this OI specifying the requirements for the training and check out of test personnel. (para 3.1) The instruction has been updated with emphasis on safety, test card production, and standard procedures for test execution. The essential elements of the 412th Test Wing (412 TW) OI 80-2, *Test Card Development*, have been incorporated into this instruction. Standardized crew duty day, crew rest, and alcohol consumption restrictions for control room personnel are incorporated into this instruction (para 4). A revision is shown by a bar (|).

1. References.

1.1. AFFTCI 11-1, *Aircrew Operations*

1.2. AFFTCI 11-2, *Ground Agency Operations*

1.3. AFI 11-202 Volume 1/AFMC Supplement 1/AFFTC Supplement 1, *Aircrew Training*

1.4. AFMCP 91-1, *Flight Safety and Technical Considerations Guide for Flight Testing*

1.5. AFFTCI 91-5, *AFFTC Test Safety Review Process*

1.6. AFMC PD 99-1, *Test and Evaluation Risk Management*

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1.7. AFFTCI 99-1, *Test Plans*

1.8. AFFTCI 99-8, *Flight Test Control Room Personnel Training and Evaluation.*

2. General:

2.1. This instruction applies to both flight and ground tests. In the body of this instruction references to flight tests apply equally to ground tests where applicable.

2.2. Test organizations at the AFFTC will conduct flight and ground tests in accordance with an approved test plan (AFFTCI 99-1) and an approved safety plan (AFFTCI 91-5). The Combined Test Force (CTF) director, United States Air Force Test Pilot School (USAFTPS) Commandant, squadron commander, or project manager will prepare written procedures in order to implement the provisions of this instruction and execute the test activity as stated in the plans.

2.3. Overall Safety. Test personnel must recognize that no guidance on test conduct can be all encompassing to the extent that test execution becomes mechanical. Test card content and procedures should not be taken as direction to do something unwise. Test aircrew, engineers, technicians, control room personnel, and maintainers should not hesitate to point out at any time circumstances that will (in their judgment) put the aircraft or crew in an unplanned hazardous situation. In short, each member of the test team must communicate (beyond challenge and response level) to resolve unforeseen situations which may occur.

2.4. Overall Security. Test personnel must follow good security practices in order to protect sensitive and classified information. Classified data will be properly marked and shared with appropriately cleared individuals on a “need to know” basis.

3. Policies:

3.1. Qualification And Training:

3.1.1. Test organizations will ensure personnel conducting flight test are current and qualified in the duties they are required to perform in support of test operations. Test organizations will document aircrew training, qualification, and currency to perform specialized flight test events, such as (not all inclusive), photo and/or safety chase, high angle of attack testing, munitions deliveries, and air drops of cargo or paratroopers. Piloting of medium and high risk events in manned aircraft by individuals other than graduates of a test pilot school will be permitted only if documented in the test plan and approved by the test approval authority. Test organizations will ensure that aircrew members operating an on-board data acquisition system receive training in the proper operation of these systems.

3.1.2. Test organizations will establish a training and checkout curriculum for test directors and test conductors (See AFFTCI 99-8, *Flight Test Control Room Personnel Training and Evaluation*). Test directors and test conductors will receive a mission evaluation annually that will include a graded observation during a test mission. The CTF Director, TPS Commandant, or squadron commander will approve qualifications and authorize test directors and test conductors to perform their duties; and will designate instructor test directors and/or conductors to conduct and document initial and/or annual checkout of test directors and test conductors during test missions. Test activities will ensure that all other essential control room personnel receive training appropriate to their assigned task and receive an evaluation prior to performing unsupervised control room activities.

3.1.3. Test organizations will ensure that maintainers and instrumentation technicians are qualified to perform their required duties through appropriate training prior to working on test articles and conducting ground or logistics tests. Test organizations will document maintenance qualifications in accordance with standard maintenance practices. Test organizations will ensure that all personnel operating data acquisition systems receive training in the proper operation of the system.

3.2. Test Conduct:

3.2.1. All ground test and flight test events will be conducted from approved test cards or written test procedures. Each flight test activity will establish and maintain a unit test card development and coordination process that includes procedures for updating and approving changes to test cards based upon lessons learned.

3.2.2. Test cards should contain the following minimum information as applicable, aircraft configuration with weight and balance, aircraft operating limits critical to the test point, test limits, initial conditions, challenge and response items as required, flight test technique, allowable data bands or test condition parameter tolerances, data acquisition system settings, expected results, risk level, go or no-go criteria, and test card number.

3.2.3. The squadron commander will approve all test cards or test procedures. In addition, the operations group commander will approve medium-risk test cards, and for high-risk tests, the wing commander will approve the test cards. Test cards will be approved prior to each test, but no earlier than one week prior to the test.

3.2.4. All test missions will be pre-briefed in accordance with AFFTC briefing guidelines (See AFFTCI 11-1). All applicable safety package test hazard analyses along with the general minimizing considerations (AFFTC Forms 5028/5028A) for all test events will be briefed regardless of risk level. The AFFTC Form 5028 requirements take precedence over those specified in the test plan. Test termination criteria and coordination with the ground control center will be briefed, as applicable.

3.2.5. Test events will be executed per the briefed test card and/or procedure unless safety would be compromised. If, in the opinion of the test director or test pilot and/or pilot in command, safety will be compromised, the test point will not be executed. The test conductor may make real-time, minor adjustments to the cards as long as the parameters involved are not safety-of-flight related and the card is a low risk card. An example of a minor adjustment would be to move the aircraft altitude up 5000 feet to avoid a bank of clouds. No real-time changes will be made to any medium or high risk test card.

3.2.6. All test missions will be debriefed to ensure that test results are properly documented. To the maximum extent possible, all test aircrew, the test director, test conductor, control room engineering representatives, and chase/support aircrew should attend the debriefing. Test organizations will ensure that daily flight or system test reports are completed and that the test data is properly transmitted to the appropriate data analysis activity. Deficiencies found during the test will be recorded and a unit flight crew information file (FCIF) notice created, if appropriate. Lessons learned from the test will be captured and incorporated into changes in the test cards, where necessary, and unusual events must be reported and investigated as required by AFFTCI 91-5.

3.3. The minimum level of test control will be determined during the safety review process and documented in the safety plan for the test activity.

4. Procedures:

4.1. Control Room Procedures. A control room is defined as any facility, ground or airborne, that provides two-way communication with the aircrew and real-time capability to monitor safety of flight and safety of test information. These instructions apply to ground control room operations and to situations where the test conductor and other key personnel are airborne in test or support aircraft. A control room must provide the ability to monitor and analyze real-time data, giving point-to-point clearance if a build-up sequence is specified in the safety plan. Each test organization will develop a written test control procedure. The intent is that:

4.1.1. Every individual in the control room be trained in his or her responsibilities and must be familiar with the responsibilities of others in the control room.

4.1.2. There is a list of unambiguous commands to be used, along with their meanings. All safety or mission critical steps in the test cards must be challenge and response, (i.e., the test conductor challenges and the test pilot responds). The test conductor must be familiar with pilot workload so challenge and response items will have proper pacing.

4.1.3. There is a single, highly experienced individual designated as the test director who acts as the supervisor of the control room and has emergency direct communication with mission test pilot.

4.1.4. There is a single, experienced individual designated as the test conductor who is the primary communicator with the test aircrew. The test conductor will clear the test pilot to proceed from one test point to the next. The test director and test conductor may be the same person for simple test missions.

4.1.5. Control room personnel assignments will remain as constant as possible. There should be continuity of personnel from mission to mission. All essential control room personnel will be in direct communication with each other and with the test conductor. All essential control room personnel will monitor aircrew-to-control room communications. In-flight video of the aircraft may be required to enhance the situational awareness of control room personnel. Any member of the aircrew or control room may recommend termination of a test point to the test conductor. Teamwork must be stressed. A test mission “dress rehearsal” should be conducted in the actual control room with test personnel before the start of the flying phase of the test program. During this rehearsal, as much of the aircraft-to-control room real-time system should be exercised as possible. Simulators may be utilized to enhance the technical and safety understanding of critical parameters for planned test conditions. Operator-in-the-loop simulations may be utilized to provide additional understanding of test system response.

4.1.6. All safety-of-flight and safety-of-test information will be continuously monitored and a procedure will be in place to immediately notify the test aircrew if safety limits are approached or exceeded or if critical data displays malfunction for any reason. Where available, the test conductor will also monitor a set of designated parameters. Graphic displays may be required to give a perceptible warning when a parameter is out of limits. Mission and test maneuver termination criteria will be established by test personnel and documented in the test plan and safety plan. Specific mission termination criteria will be discussed in the mission pre-briefing. The flight and/or test will be terminated if monitoring capability is lost for any safety of flight and/or test parameter identified in the safety plan, if data analysis indicates an aircraft and/or test limit may be exceeded on the next test point or maneuver, an aircraft limit is exceeded, or if any unexpected event occurs

during the test that in the opinion of the pilot or test director compromises safety. For remotely operated aircraft (ROA) tests, the chase aircrew or ROA operator may take control of the vehicle for safety reasons without concurrence from the control room.

4.1.7. All control room personnel will observe a period of 10 hours crew rest prior to reporting for duty and participating in a test mission. In addition, the duty day for control room personnel will not be longer than 12 hours from the time the individual reports for duty until engine shut down or test completion. For long duration test missions, test organizations should consider rotating control room personnel, but the CTF director or squadron commander may extend the crew duty day up to 18 hours for control room personnel. All personnel in the control room shall be alcohol-free for 10 hours prior to entering the control room for a test mission.

4.2. Key mission control personnel duties.

4.2.1. The following key mission duties are standard for a large test organization conducting tests using a ground control room. Depending on the complexity of the test mission an individual may fulfill more than one key mission duty. For example, the operations engineer may also perform as the test conductor and the duty pilot may also perform as the test director. In some cases, such as ground tests or flight tests where a multi-person aircraft itself is the control room, modifications to this list may be required. Contractual requirements or test activities involving multiple government agencies may also necessitate some modification of the responsibilities listed. Test organizations may modify the allocation of the key duties below if necessary, but should ensure that all essential duties are assigned to an individual and that any changes are captured in a unit OI.

4.2.2. The test director is responsible for the technical quality, security, safety, and support aspects of the mission as identified in the test plan. The test director:

4.2.2.1. Verifies that the test cards and/or procedures have been properly reviewed and approved.

4.2.2.2. Ensures key personnel attend both pre and post-test briefings. The test director will ensure that test cards and safety packages are fully briefed and will ensure that test results are properly documented.

4.2.2.3. Supervises the control room and validates qualifications of all test personnel in the control room.

4.2.2.4. Possesses the authority to terminate the test point or mission if the technical validity of the test is in question or safety is jeopardized.

4.2.2.5. Makes the final decision on the real-time selection of options during the test mission.

4.2.2.6. Has emergency direct communication with mission test pilot.

4.2.3. The test pilot is responsible for the safe operation of the test aircraft and successful completion of the test mission. If the test pilot is not the pilot in command, the pilot in command will be the final authority on aircraft safety and the test pilot will be responsible for the execution of the test points. The test pilot:

4.2.3.1. Assists the discipline engineer in preparation and review of the test plan.

4.2.3.2. Prepares or assists the operations engineer in the preparation of the safety review package and participates in the Safety Review Board.

4.2.3.3. Assists operations engineer in the preparation of test cards and reviews test points and test mission profile for safety and operational practicality.

4.2.3.4. Possesses the authority to terminate the test point or mission for any safety of flight reason.

4.2.3.5. Performs test maneuvers as briefed, or in the case of multi-crew aircraft, oversees test maneuvers as appropriate.

4.2.3.6. Leads the mission briefing and debriefing.

4.2.3.7. Completes post-mission reports as required.

4.2.4. The chase pilot is responsible for clearing airspace, being in position to take photographs, checking over the test aircraft between test points, and assisting the test aircraft in an emergency. The chase pilot:

4.2.4.1. Attends mission briefings.

4.2.4.2. Reviews all mission maneuvers with test pilot and ensures that the following items are briefed: chase position and expected results, minimum anticipated altitudes and terrain clearance, aircraft limits for both test and chase aircraft, altitude deconfliction and plan for lost sight, and rendezvous/rejoin plan.

4.2.4.3. Ensures chase crewmembers understand their duties for the mission and reviews aircrew duties in the event of an emergency in the test or chase aircraft.

4.2.5. The test conductor is responsible for real-time coordination of ground activities with the aircrew, paces the progression through the test cards as agreed to in the mission pre-briefing, defers to the test director for decisions as appropriate, and is the primary communicator to the aircraft. The test conductor may be airborne in the test or support aircraft. The test conductor:

4.2.5.1. Makes test-point terminate and go or no-go calls based on real-time engineering analyses of control room data. Terminates test points if the technical validity of the test is in question or safety is jeopardized.

4.2.5.2. Briefs test cards during mission briefing.

4.2.5.3. Briefs test hazard analyses and general minimizing considerations (AFFTC Forms 5028/5028A) for all applicable test points during mission briefing.

4.2.5.4. Coordinates control room and/or aircraft setup when required.

4.2.6. The discipline engineers from each discipline engaged in the test are responsible for the technical adequacy of their discipline’s portion of the test, and:

4.2.6.1. Is responsible for the preparation of the test plan according to AFFTCI 99-1.

4.2.6.2. Assists the operations engineer in the preparation of the safety review package and participates in the Safety Review Board.

4.2.6.3. Works with the operations engineer to prepare test procedures or test cards.

4.2.6.4. Determines what control room parameters are required.

4.2.6.5. Monitors critical data from a safety and technical standpoint.

4.2.6.6. Determines if test point was adequate and gives test conductor recommendation to repeat point or proceed.

4.2.6.7. Informs test conductor if parameters are off-scale or inoperative.

4.2.6.8. Informs test conductor when a critical parameter limit is being approached or has been exceeded by the test aircraft.

4.2.6.9. Participates in control room configuration determination.

4.2.6.10. Analyzes test data and provides assessments as to test system compliance with specifications and mission suitability.

4.2.7. The operations engineer is responsible for test preparation and initial post-test reporting. The operations engineer:

4.2.7.1. Assists the discipline engineer in preparation and review of the test plan.

4.2.7.2. Is responsible for the preparation of the safety review package and coordinates the Safety Review Board according to AFFTCI 91-5.

4.2.7.3. Constructs test cards and/or test procedures in coordination with discipline engineers, test pilots, and test conductor. Reviews test cards for compliance with safety review package. Provides test cards to the appropriate approval authority for signature. Provides approved test cards, applicable test hazard analyses, and general minimizing considerations, to test pilots, test conductor, and others, as required, prior to test mission pre-briefing.

4.2.7.4. Provides coordination between operations, engineering, and maintenance to schedule the test article, support aircraft, and test ranges. Ensures proper test article configuration and data acquisition system configuration.

4.2.7.5. Monitors and provides guidance on aircraft systems operation and data acquisition system operations during test mission.

4.2.7.6. Gathers post-mission reports and forwards test data to the appropriate data analysis activity. Ensures that lessons learned, deficiencies, or unusual flight events are documented and resolved as required.

4.2.8. The duty pilot and/or operations duty officer is responsible for advising the test pilot from the control room or operations desk on workaround and emergency procedures. For medium or high risk tests, the duty pilot and/or officer must be a rated aircrew member and familiar with the test being performed.

4.2.9. The instrumentation engineer and/or technician, if required, is responsible for the pre-flight, post-flight, and real-time operation of the data acquisition system.

4.2.10. The Range Control Officer (RCO), if required, is responsible to the test director for real-time execution and coordination of all range support both inter- and intra-range. The RCO prepares and coordinates documentation and procedures with range users and other support ranges where necessary to satisfy test mission requirements.

4.2.11. The Range Data Production Analyst (DPA), if required, is responsible for development of real-time and post-flight data products, pre-mission preparation of mission control rooms and computer systems, and operation of the mission control rooms and associated data processing systems during test mission support (real-time and post-flight). The DPA is the liaison between users

of the data support systems, airborne instrumentation project engineers, and the data processing staff. The DPA has overall responsibility for ensuring compatibility between the airborne instrumentation and ground data processing systems and interfaces.

4.2.12. The Range Safety Officer (RSO), if required, is directly responsible to the AFFTC Commander and Chief of Safety for protection of the general public. During real-time operations the RSO provides an independent safety assessment for the flights of unmanned vehicles and weapons on the Edwards' Flight Test Range. The RSO may cancel or terminate test missions that violate range safety criteria or pose a potential threat to personnel, facilities, or property. In the event of imminent danger or errant flight of these systems, the RSO may directly invoke recovery or destruct actions on these vehicles using the ranges flight termination systems or by direction to project personnel.

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Commander